

Study of the exposure to time-varying electric field in the ESEIAAT UPC School

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Abstract- In this paper, the level of exposure to time-varying electric fields up to 18 GHz in the main building of the ESEIAAT School at the Universitat Politècnica de Catalunya, located in the Terrassa Campus (Barcelona, Spain), has been studied and compared with regard to the legal regulation. Several test scenarios have been evaluated in accordance with the International Commission on Non-ionizing Radiation Protection standard.

1. INTRODUCTION

The applicable restrictions to biological effects of the electromagnetic fields (EMF) exposition are based on their health impact. The protection against harmful effect to the health requires that these basic restrictions are not exceeded. Moreover, in order to develop RF energy-harvesting systems the electromagnetic pollution threshold must be characterized. Several research works have been developed in order to characterize the impact of EMF for the general public or in specific population segments such as occupational sectors [1,2].

The Universitat Politècnica de Catalunya (UPC) is the University in engineering, architecture, science and technology in Spain and it is located in the Barcelona area. UPC in Terrassa Campus has three centres (ESEIAAT, FOOT, and CITM) where they study about 5000 students formed by 400 researchers, professors who teach a course offering of Bachelor's and master's degree courses that span all areas of industrial engineering, aerospace technology, optics and optometry, the video game industry and the multimedia technology. In this paper, the level of exposure to time-varying electric fields up to 18 GHz in the main building of the ESEIAAT School has been studied and compared with regard to the legal regulation. Fig. 1 shows a picture of the main building where the study has taken place. The remainder of the paper is organised as follows. Section 2 describes the measurement protocol in accordance with the non-ionizing radiation current standard. In Section 3 the electric field experimental results in the School rooms and laboratories are plotted and discussed with regard to the legal regulation. Finally, in Section 4 the main conclusions are drawn.



Fig. 1. Main building of the ESEIAAT School at the Universitat Politècnica de Catalunya.

2. MEASUREMENT PROCEDURE

The electric field measurements have been carried out by means of the electromagnetic field meter Wavecontrol SMP2 and a WPF18 broadband isotropic probe (1 MHz-18 GHz) to assess the radioelectric environment and the potential RF sources. Several test scenarios have been evaluated in accordance with the International Commission on Non-ionizing Radiation Protection (ICNIRP) standard [3]. That measurement procedure allows an average to be taken of the field values measured over 6 minutes at a given location without the presence of the technician. The log sampling interval is 0.5 s, whereas a sliding average type is considered (average interval 6 min). The different School rooms and laboratories have been meshed with a minimum of 9 test points, including the centre and borderlines. Fig. 3 depicts the electromagnetic field meter and the measurement configuration screen according to the ICNIRP protocol. Fig. 4 shows the basic restrictions for general public and other cases [3] with regard to time varying electric fields as well as the particular scenario studied in this work.



Fig. 3. (a) Electromagnetic field meter Wavecontrol SMP2 and a WPF18 broadband isotropic probe used for test. (b) Measurement configuration screen.

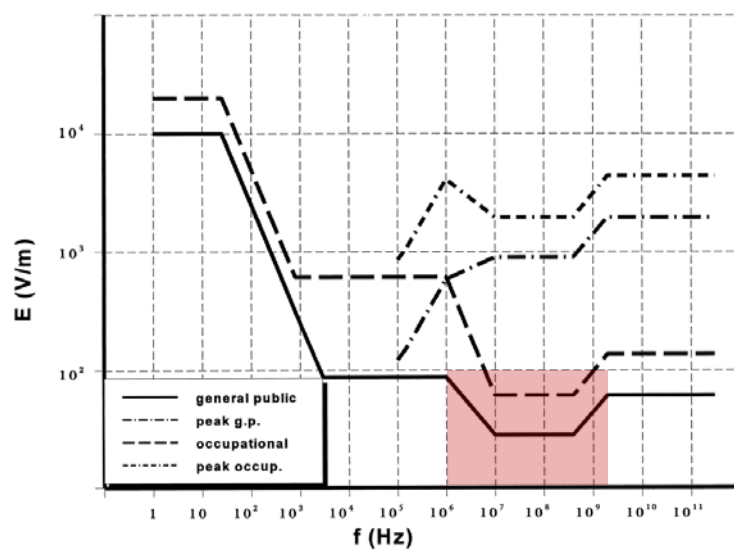


Fig. 4. Reference levels for exposure to time varying electric fields and studied case (red shaded area). Fig. partially extracted from [3].

3. EXPERIMENTAL RESULTS

Figs. 5 and 6 show the measured averaged electric field according to the methodology detailed in Section 2 in the first and ground floor of the main building. The maximum observed electric field corresponds to 2.53 V/m. This value has been measured at the sound laboratory due to the particular instrumentation of the audio studio. Since the reference level for general public exposure to time-varying electric field is ranged from 28-87 V/m in the studied frequency range (Fig. 4), we can conclude that all the scenarios under analysis comply with the standard regulation.

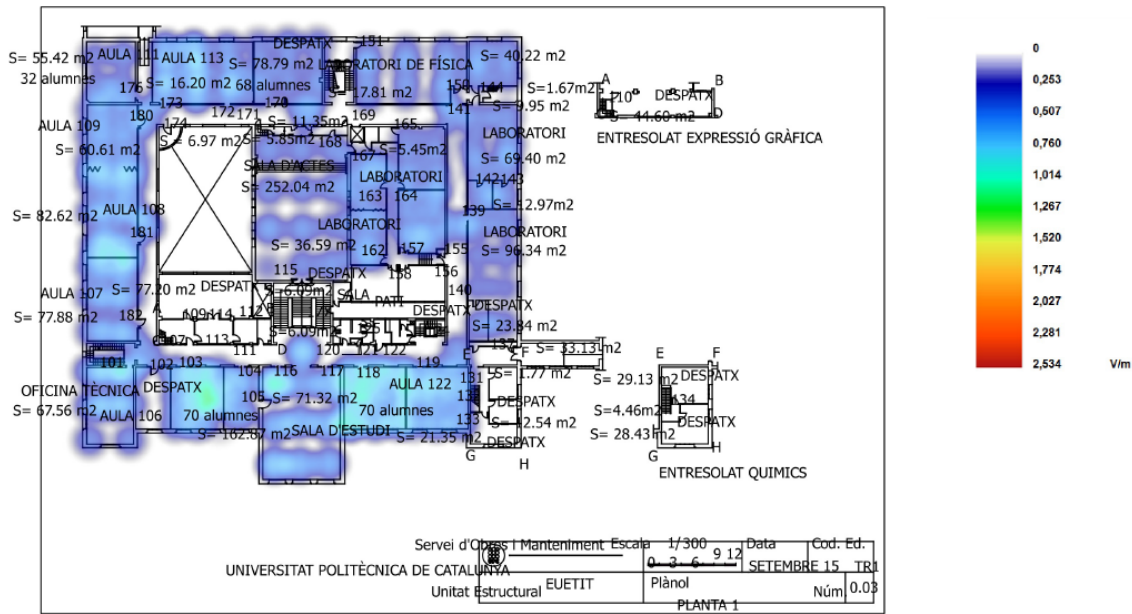


Fig. 5. Measured 6 min averaged electric field in the first floor of the ESEIAAT UPC main building where several teaching rooms and laboratories are located.

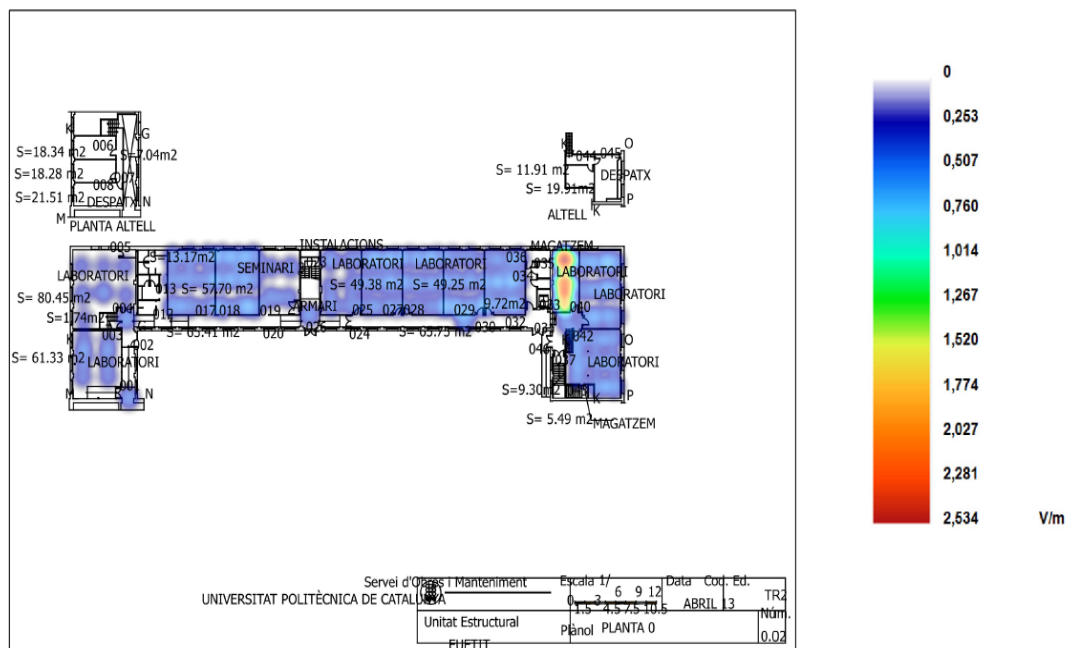


Fig. 6. Measured 6 min averaged electric field in the ground floor of the ESEIAAT UPC main building where several laboratories are located.

4. CONCLUSIONS

After this study, we can conclude that the level of electromagnetic pollution at the main building of the ESEIAAT School at the Terrasa Campus of the Universitat Politècnica de Catalunya is low with regard to the reference levels for exposure to time varying electric fields according to ICNIRP. Specifically, the maximum averaged electric field detected level does not exceed one tenth of the limit for general public exposure. Research is in progress in order to extend the frequency range analysis to lower frequencies and other areas of the Campus.

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